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larly $AC=n$, and $CB=p$. Put $\angle AGD=\phi$, $\angle CGF=\psi$, and $\angle BGE=\omega$; then, obviously, $a \sin \phi + b \sin (\beta - \phi) = m \dots (1)$,

$$c \sin \psi + a \sin (\nu - \psi) = n \dots (2),$$

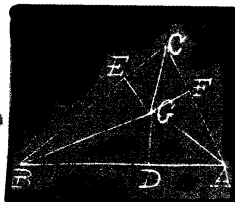
$$\text{and } b \sin \omega + c \sin [2\pi - (\beta + \nu - \omega)] = p \dots (3).$$

Knowing the values of ϕ , ψ , and ω , from (1), (2), and (3), respectively, we obtain for the pressures upon A , B , and C .

$$P_A = a[\sin \phi + \sin(\nu - \psi)] W \dots (4),$$

$$P_B = b[\sin \omega + \sin(\beta - \phi)] W \dots (5),$$

$$\text{and } P_C = c[\sin \psi - \sin(\beta + \nu - \omega)] W \dots (6).$$



II. Solution by ALFRED HUME, C. E., D. Sc., Professor of Mathematics, University of Mississippi, University P. O., Mississippi, A. H. BELL, Hillsboro, Illinois; and the PROPOSER.

Let the pressures at A , B , and C be represented by these letters.

Taking moments about AG , $b \sin \beta \cdot B = c \sin \gamma \cdot C$.

Taking moments about CG , $a \sin \gamma \cdot A = -b \sin (\beta + \gamma) \cdot B$.

Also, $A + B + C = W$. From these,

$$B = \frac{\sin \gamma}{b} W + \left(\frac{-\sin(\beta + \gamma)}{a} + \frac{\sin \gamma}{b} + \frac{\sin \beta}{c} \right) W.$$

Denoting the quantity in the parenthesis by K , we have, from considerations of symmetry, $A = \frac{-\sin(\beta + \gamma)}{aK} W$, $C = \frac{\sin \beta}{cK} W$.

Excellent solutions to this problem were received from G. B. M. ZERR, and P. H. PHILBRICK

13. Proposed by G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia.

A man, horse and buggy are going around a circular race course at a 2:40 gait. If the whole outfit weighs 1500 lbs, radius of course is 500 feet and track is inclined so that pressure is equal upon the wheels, find the pressure on the ground due to whole weight.

Solution by the PROPOSER.

In the figure, let C , the bob of the conical pendulum, represent the whole weight of man, horse and buggy $= M$. Let r = radius of curve, V = velocity per second, f = centrifugal force. Then $CG = m$, $CE = f$. Resolve CG into its components CH perpendicular to, and CL parallel to AC ; also, CE into its components $CD = CH$ perpendicular to, and CK parallel to AC .

Then pressure $= P = m \cos \theta + f \sin \theta$, where $\theta = \angle OAC$.

But $f = \frac{mv^2}{gr}$, and $v^2 = \frac{gr^2}{h}$, where $h = AO$, $r = OC$.

$$\sin \theta = \frac{r}{\sqrt{(r^2 + h^2)}}, \cos \theta = \frac{h}{\sqrt{(r^2 + h^2)}}. \therefore P = \frac{mV(r^2 + h^2)}{h}.$$

Now let abc be a section of the road bed; then abc is similar to OAC ,

$ab = a$, $bc = e$, $ac = w$. Then $\frac{\sqrt{(r^2 + h^2)}}{h} = \frac{a}{w} = \frac{a}{a \cos \theta}$. From the triangle

$$CEG \text{ we get } \tan \theta = \frac{v^3}{gr}, \cos \theta = \frac{gr}{\sqrt{(g^2 r^2 + v^4)}}; \therefore \sqrt{\frac{(r^2 + h^2)}{h^2}} = \sec \theta$$

$$= \frac{\sqrt{(g^2 r^2 + v^4)}}{gr}. \therefore P = \frac{m \sqrt{(g^2 r^2 + v^4)}}{gr}, \text{ but } m = 1500 \text{ pounds, } r = 500 \text{ feet,}$$

$v = 33$ feet per second, $g = 32$ feet. Substituting we get, $P = 1503.465$ pounds.

NOTE.—Professor Zerr constructed a diagram to accompany his solution but as the solution is sufficiently lucid without, we did not have a diagram made.

II. Solution by WILLIAM HOOVER, A. M., Ph. D., Athens, Ohio.

Let 500 feet = r = the radius of the curve described by the center of gravity of the carriage considered horizontal, a = the vertical distance of the center of gravity from the road, $2b$ = the width of the road, v = the velocity, and mg = the weight of the "outfit."

The resultant of the horizontal centrifugal force and the weight of the outfit must be perpendicular to the road, and if θ = the inclination of the road, we have, taking moments about a point in the outer circumference of the road,

$$(a \cos \theta - b \sin \theta) \frac{mv^2}{r} = mg(a \sin \theta + b \cos \theta) \dots (1),$$

$$\text{whence } \tan \theta = \frac{av^2 - bgr}{bv^2 + agr} \dots (2).$$

No value for b seems to be contemplated in the statement of the problem. Putting $b = 0$ in (2), $\tan \theta = \frac{v^2}{gr} \dots (3).$

$$\text{The whole pressure} = \frac{mv^2}{r} \sin \theta + mg \cos \theta \dots (4). \quad \text{The rest is only}$$

the numerical application of (4).

This problem was also solved by Professors MATZ, PHILBRICK and HUME.

DIOPHANTINE ANALYSIS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

13. Proposed by ARTEMAS MARTIN, LL. D., U. S. Coast and Geodetic Survey Office, Washington, D. C.

It is required to find four numbers the sum of whose fourth powers is a square number.

Solution by the PROPOSER.